Data Visualizing Housing Development Board Housing Situation in Singapore

Le Thanh AN, LAU Zi Quan, LOW Yun Vera

Abstract— In the recent years, Singapore housing situation will face problem such as ageing town with ending lease years. This research project attempts to complement with the current efforts of Housing Development Board and analysts to identify 1) The Breakdown of Flat types of towns 2) The shift of Mature and Young estates in the next few years 3) Flats Constructions meets the demand of the population in each town. With these information, we hope to help them make more informed decisions on policy and redevelopment plans ahead. In order to achieve this, we have done extensive data exploration, planning and prototype with the data provided by Housing Development Board and Statistics of Singapore. The key component of our visualization is breakdown into 3 chapters each depicts a story. First story depicts an overview of the distribution of room types breakdown, next a distribution of flats lease years and lastly, the supply and demand of flats.

Index Terms — Housing Development Board,Remaining Lease Terms, Housing Redevelopment

1 Introduction

With rising population as well as decreasing lease years and rising housing price in Singapore's Housing Development Board flats. It has become increasingly difficult for residents to own a house. The government have also been putting in efforts to address the issue of housing. This research will enable us to enhance our understanding of the current housing situation in Singapore. Whether there is an oversupply or undersupply of housing. In this project, we are interested in identifying the lease year end of each flat in each town, each room type's units sold and rented as well as the supply and demand of flats based on population in a particular town. This will provide the Housing Development Board's decision-makers to better understand the housing situation in Singapore, allowing them to make better-informed decisions.

This paper consisting of 9 main sections will be reporting on the efforts taken by the team for designing the visualisation application for respective decision makers to identify the town's remaining lease and redevelopment plans, allowing decision makers to make more informed decisions on the Housing Development Board (HDB) flats in Singapore. Section 1 will be providing an introduction of the project, followed by an overview of the motivations and objectives of the research conducted. Section 3 will be going through related works that have been done. Section 4 will proceed to discuss the visualisation approach that the team have taken followed by the data collection, exploration and preparations process that the team have done. Next, the design considerations of the application. Section 7 will be going through the key findings and insights that can be obtained from the visualization that the team have built. This will be followed by a case study to demonstrate the functional use of the visualization tool. Lastly, the paper will end by discussing the future works of the project.

2 Motivation and Objective

Our team's research is motivated by the general lack of visualization tools to discover the remaining lease years of housing development board flats in Singapore. In response to redevelopment and buyback plans, we feel that there is a need to analyse housing supply and demand to gain insights on town areas and the number of dwelling units affected. Through our research and development, we hope to develop a visualization tool that can help decision makers discover interesting patterns that could inform and help them to devise plans for Singapore redevelopment. In this project, we are interested to create a visualization that helps analysts perform the following:

- Identify the lease term of the HDB property and highlight those that are going to reach their due year.
- Identify the number of units and the number of households each town that will be affected by the relocation
- Identify how much housing should be supplied based on the household's affected by buyback.

3 Related Works

Figure 1. An illustration of related works on HDB property pricing, the left figure shows the use of data points on map and the pricing of individual property. The right figure is a choropleth map showing the distribution of population and room types within each sector area in Singapore. [1][2]

Majority of the visualization on housing properties are focused on the resale price because they are mainly consumer and real estate centric. From figure 1, you can see that the visualization dashboards are showing the individual property prices. They are good visualization which we can learn from however they are not ideal for making decisions for redevelopment. What we can consider changing is that we can identify the district by the different Town Boundaries and by their remaining lease years. Ideally, we hope that we can identify patterns and towns that would be facing ageing properties in the future so that the government can prepare policies and programs that can help in the redevelopment of these properties.

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4 Visualization Approach

In order to develop a visualization tool that can help decision makers to make better Housing Development Board redevelopment strategies and planning, we decide to split the storyboard into 3 different chapter, each telling a different story. Whereas, the development is conducted in 3 phases (1) Data collection, Exploration and Preparation, (2) Planning the Visualization Tool and (3) Developing the Visualization Tool. The first phase is elaborated in Section 5, the second phase of the design consideration is explained in Section 6 and the last phase is explained in Section 7.

5 Data Collection, Exploration & Preparation

This research project begins with the selection of a dataset which consists of information of the Housing Development Board (HDB) properties details. Data.gov.sg [3] provides a comprehensive collection of all the Housing Development Board related information from 1937 to 2018. Other relevant information like resale pricing, population and construction status data ranges from 2008 to 2016. Therefore, we need to consider looking at the property information separately because of the difference in time series data, but we can combine dataset together and identify if there is any correlation between population and construction status.

Singapore Housing Development Board planning is according to town area boundary, which pose a different purpose from the planning area and sector area boundary. Therefore, there is a need to identify the Town Area Boundary for the Map Visualization. Furthermore, there is also a lack of coordinates for the property information. Information such as postal codes, longitude and latitudes are not available. This information can be obtained online manually. However, the process would be tedious, thus we made use of Selenium with Python to automate the process of generating postal code with the block number and street name from SingPost [4] website. After which, we source out duplicates and manually identify the postal codes which have been tag incorrectly and rectify it.

As we begin our Data Exploration, we make use of an iterative approach to clean and visualize our data exploration by creating charts using Tableau. The HDB property data is then transposed with Python pandas so that we can group the number of new sales and rental of different types. After which, we merged the Postal Codes together with latitude and longitude with the properties data.

The next part of our analysis, we will be looking at if there is enough HDB constructed for the increasing population. We explored the dataset and did some simple data manipulation to obtain the difference of the estimated population living in HDB Flats and the number of units of HDB property constructed between previous year. We then merged the constructed HDB Flats and Estimated Population Living in HDB Flats data by the year and town.

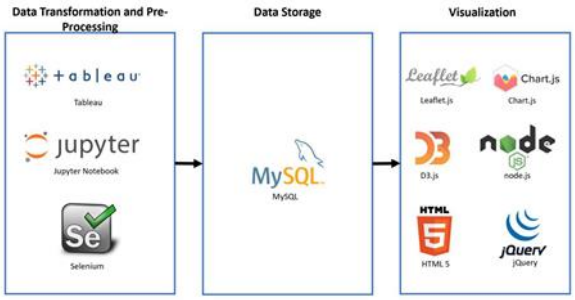

Fig 2. Architectural Diagram of our Visualization Dashboard

Finally, after the data is cleaned and finalise, we load the data into MySQL Database to query for the front-end visualization.

6 Design Consideration

Fig 3. illustrate the planning area boundaries in Singapore [5]

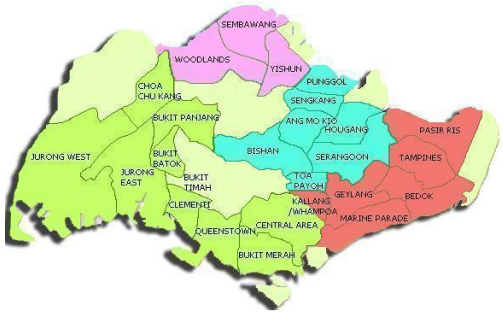

Fig 4. illustrate the town boundaries in Singapore [6]

One of the limitations we encounter in the visualization process is plotting the boundaries for new town areas. Singapore Planning Area and Subzone are different from the town boundaries which Housing Development Board uses. Singapore have a total of 23 new towns, but 55 planning area. Therefore, we made use of the new town boundaries as our visualization representation. Hence, we made the shift of using D3 maps to be replaced with image overlay to represent the town areas provided by Housing Development Board.

We also made use of the leaflet clusters to display individual points of the HDB properties upon selecting the town. As our data is stored in MySQL database, we query the data and only display the relevant data points in the front end, using JQuery, D3js, ChartJs, leaflet and then deploying on NodeJs. This will reduce the lag time, due to the cluttering of too many data points. Thus, uploading the data into a database will reduce the load time.

For our visual application we have also decided to go with a storytelling approach. In the initial iterations we planned to combine all the charts into one dashboard, however the data are from different time range and not ideal as content will be too cluttered. Therefore, we are inspired to create a dashboard with a storyline, which each chapter telling its own story in a sequential approach. Story one tells the breakdown and distribution of room types of each town. Story two shows the distribution of the town and their lease years and story three tells about the trend of population and flats constructed.

7 KEY FINDINGS & INSIGHTS

Fig 5. Our Visualization Home Page

The list below features some of the key findings and insights that can be derived from our visualization application:

1. In 2018 it was found that the only town that has the oldest buildings with lease years left less than 38 years is the town Bukit Merah. The number of Housing Development Board flats that have less than 38 years is 73 with 2216 units affected (seen in the figure below).

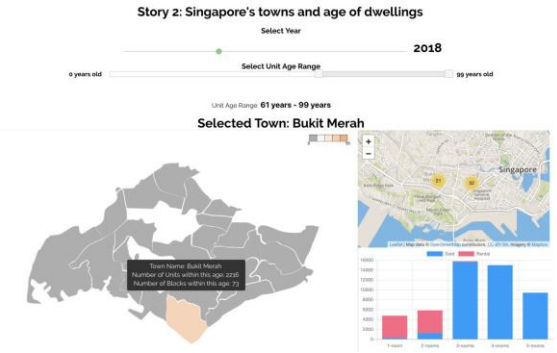

Fig 6. Screenshot of Visualization Dashboard of Bukit Merah Town

2. It has been found that there are certain mature estates with a high number of units such as Queenstown, Geylang, Tampines and Ang Mo Kio are facing ageing housing. However, Geylang and Queenstown do not have as many units affected as compared the Ang Mo Kio and Tampines. Housing development board's decision-makers should take this into account and focus on ageing towns that have higher units affected.
3. There are certain towns such as Marine Parade and Bukit Timah that do not have any 1 room Flats. This would indicate that there if Marine Parade and Bukit Timah were to be affected by the nearing lease year-end, the probability that a large number of huge households will be affected. This should be taken note of especially when catering to the flat types to the demand should there be a need to take back the flats. Especially for Marine Parade with limited lease years left.
4. The general population is moving out of generally mature towns such as Ang Mo Kio, Bedok, Bishan, Serangoon and Tampines. According to an article by Channel News Asia [7], owners of older flat units are anxious about the short lease years left and the wear and tear caused by the old flats. As many of the owners see their homes as the homes that they are going to live in when they retire.

8 CASE STUDY

For this case study, we will be looking at the visualization tool's 3 different stories. We will also be focusing on a single town (Tampines) to extract intriguing insights from the HDB flats situation in Tampines. Tampines is selected for our case study as Tampines is one of the up and coming towns but at the same time, Tampines is also a mature town. To begin our analysis, we will first start off with Story 1: New sale Flats Rental and Sold to understand the rental and sold units by room type situation in Tampines. We will first select to see the number of 1 room flats by selecting the drop down.

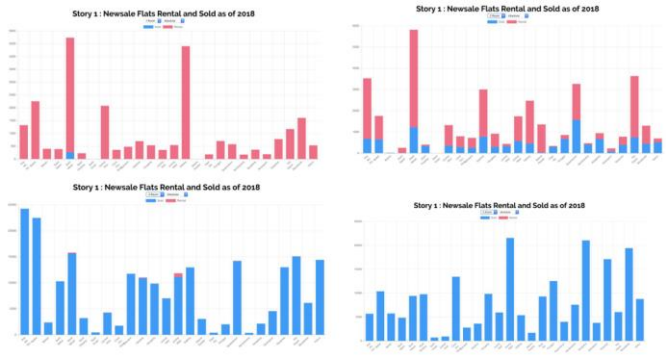

Fig 7. Story 1: Distribution of 1 Room Flats (top-left), 2 room flats (top-right),3 room flats (bottom-left) and 4 room flats (bottom-right) as of 2018

While the room size increases the number of rental flats reduces. This can be seen from figure 7. In the overall view it can also be seen that in Tampines, there are more 3-4 room flat types units as compared to the 1-2 room flat types. This should be taken into account in the event of taking back flats in the Tampines town. As there are more sold 3-5 rooms flats this would also mean that there will be a significant number of large households being affected by the re-taking of flats. Hence, there needs to be a consideration of supplying flats containing room types of 3-5 rooms.

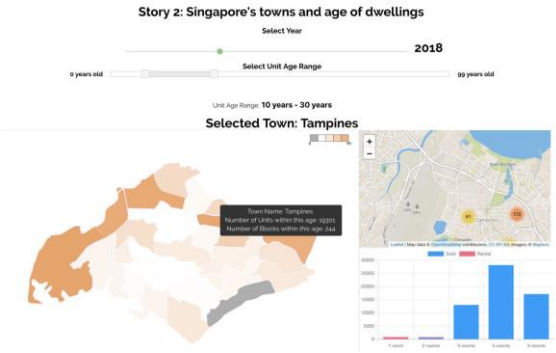

Fig 8. Story 2: Distribution of lease years bins 10 to 30 years of 2018

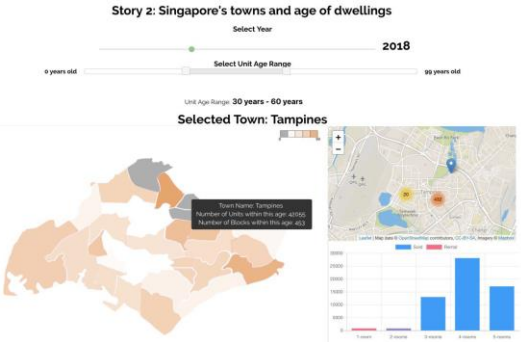

Fig 9. Story 2: Distribution of lease years bins 30 to 60 years of 2018

Next, we scroll down to the next stage of our analysis - Story 2: Singapore Towns and age of dwellings. In Tampines it is observed that there are 244 blocks of flats that are within the 10-30 years of age in 2018 and 453 blocks within the age range of 30 - 60 years. The 244 blocks within the 10-30 years of age are considered as new. However, plans are needed for the 453 flats that are within the 30-60 years as there is a huge number of flats that are within the age range. When the years increases from 2018 to 2048, decision makers have to consider the large number of units affected.

Fig 10. Story 3: Trend of new constructed flats and population of Tampines

To begin our analysis on Story 3: Supply and Demand for Tampines, we first select the Tampines Town using the dropdown list. As seen on Figure (10) we can see that there is a general dip in the population in Tampines from 2010. This is interesting as Tampines being one of the mature towns in Singapore while continuously building of new flats in the town and being a hub however, the general population is moving out of Tampines. There is a huge dip in population from 2014 to 2016 but the constructed building has constantly been on a rise. This could be a problem in the future where there is excess supply of flats.

To fully get the overall information at a glance for the HDB flat situation in Singapore one has to explore the stories of the visualization tool from new sale rental and sold, to Singapore town and age of dwellings and lastly the supply and demand of flats and population.

9 Conclusion

Through the research, it has been found out that people are generally moving out of mature towns and moving into newer towns such as Punggol. There is also a trend that as room size increases there are generally lesser rental flats and more sold flats. With the aid of our visualisation tool, it hopes to identify trends and towns that are facing lease year end at the same period. At the same time, using our visualisation tool as an exploratory platform and guide decision makers in to making better informed decision. In the future this research could be extended to explore any possible implication of age of housing would have on the resale price of the flat. Subsequently, to visualize the number of transactions over the years to identify units used as investment instead of accommodation.

Acknowledgments

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